

# Reproductive Cycle and Oogenesis of *Puntius Sophe* from Gho-Manhasan Stream of Jammu region, India

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**Abstract-** *Puntius sophe* collected from Gho-Manhasan river were dissected and ovaries were histologically studied throughout the year. Seven stages of oocytes were recognised in *Puntius sophe*. Oogonia were present throughout the reproductive cycle. The most important event observed during the study was the observation of crystalline yolk, atretic oocytes in the maturation stage and spent phase respectively. The breeding period of the fish is from July-August.

**Index Terms-** Reproductive cycles, oogenesis, atretic oocytes, *Puntius sophe*, Gho-Manhasan stream

## I. INTRODUCTION

Fish makes a vital contribution to the survival and health of a significant portion of the world's population. Fish is especially important in the developing world. In some of Asia's countries (Bangladesh and Cambodia) people derive as much as 75% of their daily protein from fish. Often referred to as "rich food for poor people" fish provides essential nourishment, especially quality proteins and fats (macronutrients), vitamins and minerals (micronutrients). Second, for those involved in fisheries, aquaculture and fish trade, fish is a source of income which can be used to purchase other additional food items. Therefore, the breeding of fish for food, for recreation and aesthetic needs or in the context of conservation of natural species against environmental harm is of global importance. As fish live usually in closest contact with their environment (aquatic ecosystem/ waterbodies), rather they are extremely dependent on it and hence get affected by any changes in its quality. Fish health thus may also reflect and give a good indication of the health status of a specific aquatic ecosystem, thereby acting as a "warning signal" to indicate the presence of pollutants in natural water.

Fish reproduction though has been extensively studied is definitely one of the factor seriously affecting internal milieu of the organism. Breeding period may itself cause the physiological stress in fishes. It is on record that production of testosterone during breeding season may involve a concomitant reduction in male immune defense (Folstad and Karter, 1992). In recognition of the fact that knowledge about reproductive biology is very essential if any species has to be studied for culture or conservation. Several workers have in past tried and contributed on various aspects of reproductive biology of fishes, the reviews of oocyte development in teleosts have been given by deVlaming (1983), Gaurya (1986,1994), Selman et.al. (1993) Bromage and Cumaranatunga (1988), Selman and Wallace (1989), West (1990) and Tyler and Sumpter (1996). *Puntius*

*species* breeds throughout the year under laboratory conditions, with large number of spawns (Varadi and Horvath,1993; Adam, 1995; Adam et.al, 1995). K F EL-Borey (2004) reported the reproductive biology, sexual maturity and sex ratio of male and female *Rhabdosargus hafford* in Suez city. Ghaffari and Jamili (2010) studied the reproductive biology, GSI, absolute fecundity of *Barbus pectoralis* and reported the breeding time of fish from January to February.

Menni et al. (2010) define a coastal ecosystem (South-Western Atlantic coastal ecosystem, SACE) and studied the reproductive biology and biological characteristics of chondrichthyans

Behara et.al (2005) carried out studies on the fecundity of striped *Gourami colisa fasciatus* (Bloch and Schneider ) and reported that ovary weight is the index of fecundity in comparison to total length body weight ovary length of the fish as they recorded highest correlation between fecundity and ovary weight.

Principal objectives of the present investigation were to describe oogenesis by the classification of developing oocytes into different stages using histological examination, to study breeding season of *Puntius sophe*.

## II. MATERIAL AND METHODS

### Collection area:

Fishes were collected from their natural habitat from a stream at Gho-Manhasan located at a distance of 20km north west of Jammu city (32° 67' Lat N; 70° 79' Long E).

Fish *Puntius sophe* were collected from their natural habitat from a stream at Gho-Manhasan and these were acclimatised in plastic troughs at room temperature. They were fed on live feed and formulated feed, every alternate day dead fish were removed.

## III. OVARIAN HISTOLOGY AND DATA ANALYSIS

Fragments of ovary were fixed in Bouin's fixative. After dehydration in ethanol, these were embedded in paraffin and 5-7µm section were stained using Mallory's trichrome and Harris hematoxyline and eosine.

## IV. RESULTS AND DISCUSSION

Under present investigation, gonadal studies maturation studies were conducted in female only due to less availability of mature males.

In this study it was investigated that young females attain maturity while they were in their first year of life. The smallest mature female was 4.1cm (TL) and 4.31gm ( BW) .50% of fish mature at the average length of 5.5cm and weight of 4.5 gms.

Histology of Gonads: Based on histological examination seven developmental stages were found in the fish. Oocyte diameter and percental occurrence of the oocyte stages was observed as given in the Table I & II.

**Oocyte stage I :** Oogonia and perinucleolus stage were observed in the ovigerous folds oriented towards the centre of the ovary. They were spherical in form with transparent cytoplasm. The nucleolus is central or ascetric in position. This stage is also known as chromatin nuclear stage. The diameter of oogonia is 0.26 $\mu$ m in december which increases to 0.36 $\mu$ m in July-August. The percental occurrence of stage I oocytes were 10.04 $\pm$  1.43 to 15.13 $\pm$ 4.33 in June –August and maximum percental occurrence was observed in December 69.49 $\pm$ 2.57 and January 56.47 $\pm$ 2.57. Various authors reported the similar results of stage I, like Yamamoto and Yamazaki (1961), Malhotra (1978), Gupta (1980), Singh (2009), Hina (2010) and Vohra(2011).

**Oocyte stage II :** The stage II oocytes are characterised by an increase in size i.e. 0.38 $\pm$  0.034 to 0.96 $\pm$  0.06 in August and February respectively. The oocyte diameter is minimum in August and show an increase in December. The nucleus of the oocyte increases in size and the number of nucleoli increased and occupy the peripheral position inside the nuclear membrane. With the advancement of this stage the ooplasm increases and become much greater in volume than the nucleus. The percental occurrence of stage II oocyte were 6.07 $\pm$  5.27 to 8.30 $\pm$  1.02 in August- September with minimum percentage of 2.29 $\pm$  3.97 in May and with highest percental occurrence 31.2 $\pm$  6.89 to 33.8  $\pm$  0.86 in october and november. Work of various authors resembles with the present results of stages II oocytes like Yamamoto and Yamazaki (1961), Malhotra *et al.* (1978), Gupta (1980), Agarwal (1982), Singh (2009), Hina (2010) and Vohra(2011).

**Oocyte stage III :** The oocytes of this stage are recognised by the appearance of minute vacoules, the yolk vesicles in the peripheral part of the ooplasm. A few of the nucleoli were seen piercing through undulating membrane to enter the ooplasm. Appearance of vitelline membrane central to follicular epithelium and theca externa to follicular epithelium has been noticed in this stage. Oocyte diameter ranges from 0.9 $\pm$ 0.062 to 1.04 $\pm$  0.034 in November and June respectively. The maximum percentage of these oocytes was observed in June 33.06 $\pm$  4.03 and minimum in July-August (1.58 $\pm$  2.74 to 6.07  $\pm$  5.27). Phenomenon of nuclear extrusion has been previously reported by Jyoti (1972), Gupta (1980), Ali (2003), Singh (2009), Hina (2010) and Vohra (2011).

**Oocyte stage IV :** The ooplasm of this stage oocyte are filled by yolk vesicles and increase in number. The oocyte grow in size and the size ranged from 0.36 $\pm$ 0.62 to 1.24 $\pm$  0.015 $\mu$ m. Percental occurrence of stage IV oocyte ranges from 1.38 $\pm$  2.4 to 36.33 $\pm$  1.6 with maximum in the month of May. The stage IV oocytes in present study resembles that of Hina (2010) who noted

appearance of yolk vesicles in peripheral part of ooplasm and their presence in entire ooplasm.

**Oocyte stage V :** During this stage all the three egg membranes viz, theca, follicular epithelium and vitelline membrane were developed and clear and comparatively thicker than the cell oocytes of previous stage. The oocytes attain a size of 1.369 $\pm$ 0.62 to 2.46  $\pm$  0.06  $\mu$ m during this stage. Similar stages has been reported by Hina (2010) while studying on different fishes. Maximum percentage of stage V oocytes 50.46 $\pm$ 12.46 was during July and no stage v oocyte has been observed in the month of Oct- Jan.

**Oocyte stage VI :** The oocytes of this stage begins to appear granular as small yolk vesicles has become full in the cytoplasm in last stage. Yolk vesicles are present near the periphery of oocytes and accumulate in high number. The yolk granules then proceed centripetally to the entire cytoplasm and become impregnated with them. The three egg membranes viz, theca, follicular epithelium and vitelline membrane become more thicker in this stage. The oocytes measured to be 1.2 $\pm$ 0.06 $\mu$ m to 2.37 $\pm$ 0.13 $\mu$ m during this stage, Maximum oocytes were observed in the month of July and least in Oct-Jan. Hina (2010), Vohra (2011) also observed the appearance of yolk granules in the peripheral part of ooplasm and their centripital movement towards centre during this stage.

**Oocyte stage VII :** The oocytes further increases in size, the average diameter ranges from 1.02 $\pm$ 0.06 $\mu$ m to 2.46 $\pm$ 0.06 $\mu$ m with maximum number in of stage VII in July-August (50-65%) and least in the month of Oct-Feb. The nucleus has been observed towards the periphery of the oocytes, so this stage is also known as migratory nucleus stage. Similar observations has been reported by Hina (2010) while studying on different fishes. Based on the present investigation it can be interpreted that the ovarian activity of *Puntius sophore* follows a cyclic pattern and that can be divided broadly into six phases viz. Immature /virgin phase(September-October), early maturing phase (November-January), developing phase( Feb=March), developed phase (June-July) and spent/resting phase (August).

## V. CONCLUSION

Thus, the present study has demonstrated the reproductive cycle of *Puntius sophore* during the different seasons of the year. Seven oocyte stages observed during the present investigation has been divided into six reproductive phases during the year with a peak of breeding period during the monsoon (July-August).

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**Table 1. Percent occurrence of oocyte stages in P.sophore during the year.**

Months	OOCYTE STAGES				
	III	IV	V	VI	VII
SEP	27.59±2.67	8.30±1.02	16.9±10.29	17.83±0.41	29.5±7.68
OCT	43.79±3.20	31.2±6.89	21.81±11.69	3.16±5.47	0±0
NOV	46.75±0.89	33.8±0.86	19.14±2.53	1.38±2.40	0±0
DEC	69.49±10.33	23.23±8.19	7.26±2.17	0±0	0±0
JAN	56.47±2.57	26.46±3.74	12.17±3.65	5.28±2.36	0±0
FEB	42.91±0.82	22.13±2.49	15.94±0.65	12.2±1.57	6.75±1.09
MAR	28.76±3.10	23.58±5.16	21.23±4.77	14.83±4.10	11.54±3.41
APR	30.53±2.45	24.18±6.48	16.56±5.10	13.93±2.96	14.76±3.92
MAY	24.10±1.89	2.29±3.97	22.43±3.00	36.33±1.60	16.23±1.26
JUN	10.04±1.49	7.22±7.14	33.06±4.03	24.06±6.25	25.30±0.53
JULY	15.13±4.33	8.77±10.95	1.58±2.74	24.56±8.04	50.45±12.67
AUG	22.56±1.09	6.07±5.27	6.07±5.27	23.33±8.01	40.90±1.86

**Table 2. Oocyte diameter in P.sophore during the year.**

Stages	III	IV	V	VI	VII
Months	Oocyte diameter in $\mu\text{m}$				
SEP	<b>0.3±0.06</b>	<b>0.58±0.034641</b>	<b>0.96±0.06</b>	<b>1.02±0.06</b>	<b>1.2±0.06</b>
OCT	<b>0.32±0.034</b>	<b>0.62±0.034</b>	<b>0.98±0.09</b>	<b>0.38±0.65</b>	<b>0±0</b>
NOV	<b>0.34±0.06</b>	<b>0.68±0.034</b>	<b>0.9±0.06</b>	<b>0.36±0.62</b>	<b>0±0</b>
DEC	<b>0.26±0.034</b>	<b>0.62±0.034</b>	<b>1.02±0.06</b>	<b>0±0</b>	<b>0±0</b>
JAN	<b>0.3±0.034</b>	<b>0.58±0.09</b>	<b>1±0.09</b>	<b>1±0.09</b>	<b>0±0</b>
FEB	<b>0.34±0.034</b>	<b>0.96±0.06</b>	<b>1±0.034</b>	<b>1.02±0.15</b>	<b>1.3±0.18</b>
MAR	<b>0.28±0.034</b>	<b>0.62±0.03</b>	<b>0.96±0.06</b>	<b>1.04±0.034</b>	<b>1.36±0.09</b>
APR	<b>0.32±0.034</b>	<b>0.66±0.06</b>	<b>0.92±0.06</b>	<b>1±0.06</b>	<b>1.38±0.06</b>
MAY	<b>0.34±0.06</b>	<b>0.66±0.06</b>	<b>1±0.09</b>	<b>1.1±0.034</b>	<b>1.4±0.12</b>
JUN	<b>0.32±0.09</b>	<b>0.56±0.09</b>	<b>1.04±0.034</b>	<b>1.14±0.03</b>	<b>2.37333±0.13</b>
JULY	<b>0.36±0.06</b>	<b>0.42±0.036</b>	<b>0.36±0.062</b>	<b>1.24±0.015</b>	<b>2.46±0.06</b>
AUG	<b>0.34±0.09</b>	<b>0.38±0.034</b>	<b>1.02±0.06</b>	<b>1.22±0.06</b>	<b>2.4±0.06</b>

M+SD = Mean + Standard deviation

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